We Claim:

FIRST SET OF CLAIMS

1. An aircraft, comprising:

a fuel source configured to provide a fuel;

an oxidizer source configured to provide an oxidizer;

a fuel cell configured to react the fuel with the oxidizer to operate at a given power-generation rate; and

a controller configured to regulate the reaction pressure of a reactant of the group consisting of the fuel and the oxidizer;

wherein the reaction pressure is regulated to be less than one atmosphere with the aircraft at a cruise altitude and the fuel cell operating at the given power-generation rate.

2. The aircraft of claim 1, wherein the cruise altitude is in the range of 55,000 to 70,000 feet.

3. The aircraft of claim 1, wherein the reaction pressure of the reactant is not greater than 11 psia.

4. The aircraft of claim 1, wherein the reaction pressure of the fuel is not greater than 11 psia, and wherein the reaction pressure of the oxidizer is not greater than 11 psia.

5. The aircraft of claim 1, wherein the reaction pressure of the reactant is not greater than 10 psia.

6. The aircraft of claim 1, wherein the reaction pressure of the fuel is not greater than 10 psia, and wherein the reaction pressure of the oxidizer is not greater than 10 psia.

7. The aircraft of claim 1, wherein the reaction pressure of the reactant is not greater than 6 psia.

8. The aircraft of claim 1, wherein the reaction pressure of the reactant is approximately 6 psia and the cruise altitude is in the range of 55,000 to 70,000 feet.

9. The aircraft of claim 1, wherein the controller is further configured to regulate the reaction pressure of the reactant in response to the power requirements of the aircraft.

10. The aircraft of claim 1, wherein the oxidizer source comprises an inlet for ambient air and a compression mechanism configured to compress the ambient air.

11. The aircraft of claim 10, wherein the controller is further configured to regulate the reaction pressure of the oxidizer by regulating the amount by which the compression mechanism compresses the ambient air.

12. The aircraft of claim 1, wherein the fuel source comprises a hydrogen tank containing liquid hydrogen, and a heat source for controllably boiling the liquid hydrogen.

13. The aircraft of claim 12, wherein the controller is further configured to regulate the reaction pressure of the fuel by regulating the rate at which the heater boils the liquid hydrogen.

14. The aircraft of claim 1, wherein the controller is further configured to regulate the reaction pressure of the fuel to be no greater than a predetermined increment above the reaction pressure of the oxidizer.

15. The aircraft of claim 1, wherein:

the oxidizer source comprises an inlet for ambient air and a compression mechanism configured to compress the ambient air;

the fuel source comprises a hydrogen tank containing liquid hydrogen, and a heat source for controllably boiling the liquid hydrogen; and

the controller is further configured to regulate the reaction pressure of the oxidizer by regulating the amount by which the compression mechanism compresses the ambient air, and to regulate the reaction pressure of the fuel by regulating the rate at which the heater boils the liquid hydrogen; and

the controller is further configured to regulate the reaction pressures of the fuel and the oxidizer such that the power-generation rate of the fuel cell varies in response to the power requirements of the aircraft, and the reaction pressure of the fuel is no greater than a predetermined increment above the reaction pressure of the oxidizer.

16. The aircraft of claim 15, wherein, with a cruise altitude in the range of 55,000 to 70,000 feet, the reaction pressure of the oxidizer is approximately 6 psia, and the predetermined increment is approximately 4-5 psi.

SECOND SET OF CLAIMS

17. An aircraft, comprising:

a hydrogen source including a hydrogen tank and a mechanism configured to regulate delivery of hydrogen from the hydrogen tank;

an oxygen source including a compression mechanism configured to compress ambient air from outside of the aircraft;

a fuel cell configured to react hydrogen from the hydrogen tank with oxygen from the compression mechanism to generate power; and

a control system configured to control the operation of the hydrogen source and the oxygen source at a given aircraft flight condition such that the fuel cell reacts oxygen at a first reaction pressure with hydrogen at a second reaction pressure, wherein the first reaction pressure is less than one atmosphere, and wherein the difference between the first reaction pressure and the second reaction pressure is no greater than a predetermined limit.

18. The aircraft of claim 17, wherein the second reaction pressure is less than one atmosphere.

19. The aircraft of claim 17, wherein the control system is configured to vary the first and second pressures based on power requirements of the aircraft.

20. The aircraft of claim 19, wherein the control system is configured such that at a stratospheric flight condition, the first pressure is approximately 6 psia, and the predetermined limit is not greater than 5 psi.

THIRD SET OF CLAIMS - RELATED TO OLD CLAIMS 1-6

21. An aircraft power system configured to generate a given level of power using a reactant, comprising:

a fuel cell configured to generate power using the reactant in a gaseous state, the fuel cell being configured for gaseous reactant to be supplied at an operating-rate of flux and at a given pressure that is less than one atmosphere in order to generate the given level of power; and

a tank configured for containing the reactant in a liquid state, wherein the tank includes a heat source for controlling a boiling rate of the reactant;

wherein the tank is configured to supply gaseous reactant to the fuel cell at a rate determined by the boiling-rate of the reactant; and

wherein the heat source is configured to increase the boiling rate of the reactant to a level appropriate to supply the gaseous reactant to the fuel cell at substantially the operating-rate of flux and at the given pressure.

22. The aircraft power system of claim 21, for use in a given range of ambient conditions including conditions characterized by an ambient temperature higher than the boiling point of the reactant, wherein the tank is insulated such that the boiling rate of the liquid reactant due to heat flux from the ambient conditions, through the insulated tank, is lower than the boiling rate necessary to supply the gaseous reactant to the fuel cell at substantially the operating-rate of flux.

23. The aircraft power system of claim 22, wherein the ambient conditions include stratospheric flight conditions.

24. The aircraft power system of claim 21, wherein the tank is configured to contain cryogenic hydrogen, and where the fuel cell is configured for a reactant of gaseous hydrogen.

25. The aircraft power system of claim 21, wherein the heat source is an electrical heating element.

26. The aircraft power system of claim 21, wherein the given pressure is approximately 2-3 psia.

27. The aircraft power system of claim 21, wherein the given pressure is no greater than 11 psia.

28. The aircraft power system of claim 21, wherein the given pressure is no greater than 10 psia.

29. The aircraft power system of claim 21, wherein the tank comprises:

an inner aluminum tank liner having an outer carbon layer;

an outer aluminum tank liner having an outer carbon layer; and

connectors extending between the inner and outer aluminum tank liners to maintain their relative positions with respect to each other;

wherein the volume between the inner and outer tank liners is evacuated to minimize heat transfer between the contents of the tank and the outside environment; and

wherein the connectors are configured with holes in their walls to minimize direct heat-conduction between the contents of the tank and the outside environment.

FORTH SET OF CLAIMS - RELATED TO OLD CLAIM 7

30. A stratospheric aircraft configured to be powered using a reactant, comprising:

an airframe configured for stratospheric flight; and

a power system configured to generate a given level of power using a reactant, the power system including:

a fuel cell configured to generate power using the reactant in a gaseous state, the fuel cell being configured for gaseous reactant to be supplied at an operating-rate of flux and at a given pressure that is less than one atmosphere in order to generate the given level of power; and

a tank configured for containing the reactant in a liquid state, wherein the tank includes a heat source for controlling a boiling rate of the reactant;

wherein the tank is configured to supply gaseous reactant to the fuel cell at a rate determined by the boiling-rate of the reactant; and

wherein the heat source is configured to increase the boiling rate of the reactant to a level appropriate to supply the gaseous reactant to the fuel cell at substantially the operating-rate of flux and at the given pressure.

31. An aircraft as recited in any of claim 30, and further comprising solar cells configured to provide power to the aircraft when the sun illuminates the solar cells.

32. The aircraft power system of claim 30, wherein the given pressure is approximately 2-3 psia.

33. The aircraft power system of claim 30, wherein the given pressure is no greater than 11 psia.

34. The aircraft power system of claim 30, wherein the given pressure is no greater than 10 psia.

FIFTH SET OF CLAIMS - RELATED TO OLD CLAIMS 8-14

35. An aircraft, comprising:

a hydrogen source;

an oxygen source; and

a fuel cell configured to react hydrogen from the hydrogen source with oxygen from the oxygen source to generate power, wherein the fuel cell is configured to react the hydrogen with the oxygen at pressures of less than one atmosphere.

36. The aircraft of claim 35, and further comprising an aircraft engine configured to provide thrust from the power generated by the fuel cell.

37. The aircraft of claim 35, wherein the aircraft is configured for continuous operation in conditions equivalent to an altitude of 55,000-70,000 feet.

38. The aircraft of claim 35, wherein the fuel cell is configured to react the hydrogen with the oxygen at pressures of approximately 2-3 psia.

39. The aircraft of claim 35, and further comprising solar cells configured to provide power to the aircraft when the sun illuminates the solar cells.